NASA Centennial Challenge: Three Dimensional (3D) Printed Habitat, Phase 2

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ABSTRACT

The NASA Centennial Challenges: 3D-Printed Habitat Challenge seeks to develop the fundamental technologies necessary to manufacture an off-world habitat using mission recycled materials and/or local indigenous materials. The vision is that autonomous habitat manufacturing machines will someday be deployed to the Moon or Mars to construct shelters for human habitation.

NASA and Bradley University, are holding a new US$ 2.5 million competition to design and build a 3-D printed habitat for deep space exploration, including the agency's journey to Mars.

The multi-phase 3-D Printed Habitat Challenge, part of NASA's Centennial Challenges program, is designed to advance the additive construction technology needed to create sustainable housing solutions for Earth and beyond.

The first phase of the competition ran through Sept. 27, 2015. This phase, a design competition, called on participants to develop state-of-the-art architectural concepts that take advantage of the unique capabilities 3-D printing offers. The top 3 prizes with a prize purse of $40,000 were awarded at the 2015 World Maker Faire in New York.

The second phase of the competition is called the Structural Member Competition and it is divided into three levels happening in the Spring and Summer of 2017.

The Compression Test Competition (Level 1) focuses on the fabrication technologies needed to manufacture structural components from a combination of indigenous materials and recyclables, or indigenous materials alone. For Level 1, teams will develop 3D printable materials, build a 3D printing machine, and print two specimens: a truncated cone and a cylinder.

The Level 2 Beam Member Competition is the second of three sub-competitions within the overall Structural Member Competition. For Level 2, teams will print a beam that will be tested.

The Level 3 Head to Head Competition is the third of three sub-competitions within the overall Structural Member Competition. For Level 3, teams will develop 3D printable materials, use a 3D printing machine, and print three compression specimens of the elected material, three flexural specimens of the elected material, and one dome structure. Tests conducted on the specimens and the dome structure will determine Level 3 scores and awards.

On Earth these same habitat manufacturing capabilities could be used to produce housing wherever affordable housing is needed and access to conventional building materials and skills is limited. Terrestrially, it is envisioned that local indigenous materials (dirt, clay, sand, etc.) could be combined with readily available recyclable materials and used to construct semi-permanent shelters against environmental elements for human habitation. The goal of the 3D-Printed Habitat Challenge is to foster the development of new technologies necessary to additively manufacture a habitat using local indigenous materials with, or without, recyclable materials. This paper will summarize the Level 2 results of this NASA Centennial Challenge competition and it will discuss related technology advancement